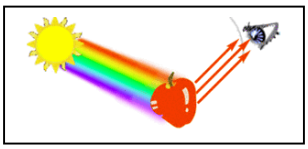


Activity #6

Title: Observing Colors-Teacher's Copy

(Lab teams of two persons each)

Note to the teacher: Having previously completed Activities #1-5, the student is now aware that "white" light is actually made up of several colors--red, orange yellow, green blue and violet. This activity will allow the student to investigate the effects of reflection, absorption and transmission of light.

A week in advance of this activity have your students bring in the specified colors of crayons listed below.

Prerequisites:

- Students should be made aware that in order to see an object it must either produce light of its own (i.e., the Sun, a light bulb, etc.) or have light reflected from it, which then enters the eye.

Purpose: to investigate the appearance of several colored objects under different viewing conditions

Materials: 2 sheets each of black and red construction paper cut into 2" x 4" strips (1 strip each per team),

blank white paper (1 per team),

red and blue filters (gels) cut into 2" x 5" strips (1 each per team),

red crayon (1 per team) listed in order of preference: orange-red, wild strawberry, radical red, red (Crayola brand)

blue crayon (1 per team) listed in order of preference: blizzard blue, aquamarine,

Internet access on a classroom computer

Materials Sources: red & blue filters: #250 medium-red XT and #850 primary blue; Great American Products (GamProducts., Inc.), 826 N. Cole Ave., Hollywood, CA 90038 (**http://www.gamonline.com/index1.php**); tel. 1-888-GAMCOLOR; 20" x 24" sheet; $6.25.

Gels can be obtained through local theatrical supply stores or also through Roscolux Filters, 52 Harbor View, Stamford, CT. 06902, (http://www.rosco-ca.com) tel. 1-800-767-2669; #80 Primary Blue, #27 Medium Red gels

Note to the teacher: Because theatrical gels meet rigid standards and allow only specified wavelengths of light pass through, they are quite expensive. If funding is a concern, colored cellophanes from gift shop and craft stores could possibly be used as a replacement. Experiment beforehand to determine the colors of crayon to be used in the following activity that will yield the best results for the particular cellophane used.

For a few bonus points, your students will be happy to rummage through their crayon boxes at home for the specific colors used in this activity.

National Standards addressed:

Science as Inquiry

CONTENT STANDARD A:
As a result of activities in grades 5-8, all students should develop

- abilities necessary to do scientific inquiry through the use of appropriate tools and techniques to gather, analyze, and interpret data.
- understandings about scientific inquiry by the development of descriptions, explanations, predictions, and models using evidence.

Physical Science

CONTENT STANDARD B:
As a result of their activities in grades 5-8, all students should develop an understanding of:

TRANSFER OF ENERGY

- Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection). To see an object, light from that object--emitted by or scattered from it--must enter the eye.

Procedure:

1. Illuminated by the classroom's overhead fluorescent lights, PREDICT what color the blank white paper, the blank red construction paper strip and the blank black construction paper strip will appear when viewed through the red and blue gels. Enter your "PREDICTION" on the accompanying answer sheet's Data Chart #1.

2. Now actually view the white, red, black papers though the gels and record your findings on the "OBSERVATION" lines of your data chart. (Note: When viewing, hold the sheet of white paper and the strips of colored paper overhead, so that the room lights are BEHIND the papers. This will reduce any reflected "glare" from the papers, which would lead to inaccurate observations.)

3. To help understand what you have just observed, respond to the following questions on your answer sheet:

a. Is there any red light reflecting from the white paper?

b. How do you know?

c. Is there any red light reflecting from the red paper?

d. How do you know?

e. Is there any red light reflecting from the black sheet?

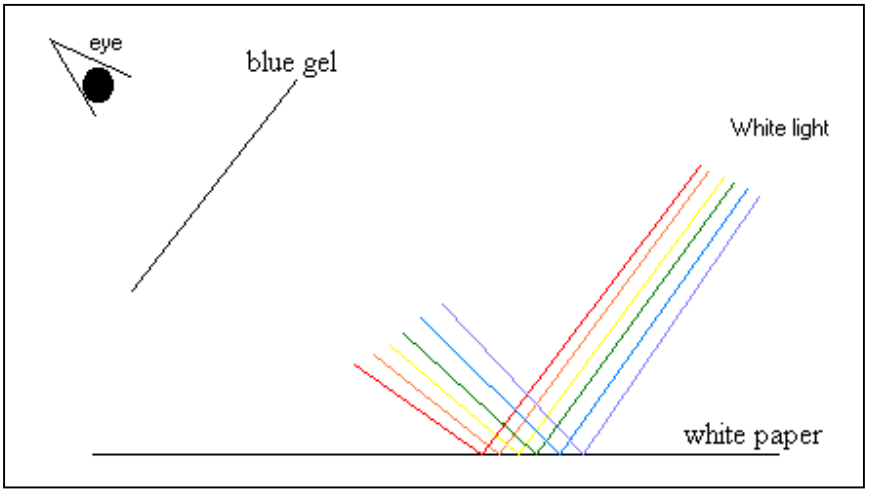
f. How do you know?

g. What color(s) of light must be passing THROUGH your red gel?

h. What colors of light must be passing THROUGH your blue gel?

i. From where is the red and blue light coming that is reflected from your white paper?

4. Copy the following diagram onto your answer sheet and complete the paths of the reflected colors of light from the white paper, through the blue gel and into your eye. Remember: The gel will absorb some colors and others will be transmitted (passed through).



5. How would your diagram in #4 be different if the blue gel was replaced with a red gel?

6. Now print a word using the red crayon on the white, red and black papers. Write a second word (on top of the first) on each sheet using the blue crayon. (Don't worry if the resulting text is difficult to read!) Now PREDICT how the specified messages will appear when viewed through the selected gels by filling in the PREDICTION lines of Data Chart #2.

7. Once you've made your predictions, now actually view the words you've written on each paper through the gels and record your findings on the OBSERVATION lines of Data Chart #2.

8. What color of light gets reflected off the blue crayon?

9. What color(s) of light get transmitted through a blue filter?

10. How do you know that blue light gets reflected from the white paper?

11. Explain WHY the blue gel produces the blue crayon image that you observed on the white paper.

12. To view a red message written on a white paper, what color gel would you need?

13. To view a red message written on a black paper, what color gel would be needed?

14. Astronomers often use gels when observing photos of celestial objects to allow only certain wavelengths (colors) of light to pass through to their eyes. This process selectively filters out unwanted areas of the image to make it less confusing for analysis. Go to the website http://antwrp.gsfc.nasa.gov/apod/ap980208.html on your classroom computer to view an image of the

Crab Nebula, a remnant of a supernova explosion that occurred in 1054 A.D. Predict what color gel you would use (red or blue) to allow only the outer edges of the nebula to be viewed.

15. Now view the image on the computer screen through your selected gel to verify your prediction. Were you correct?

16. Describe the appearance of the same image when viewed through the gel that you DIDN'T select in # 14 above.

Technology integration: The following websites offer enrichment exercises to supplement this activity:

- http://www.glenbrook.k12.il.us/gbssci/phys/Class/light/u12l2c.html -- Light Absorption, Reflection, and Transmission
- http://www.learner.org/teacherslab/science/light/index.html -- "Light in Color" and "Laws of Light"
- http://www.physics.rutgers.edu/hex/visit/lesson/lesson_links1.html -- Dozens of science lesson plans for grades K-12.
- http://www.fi.edu/color/ -- "Light & Color"…with links to several other related websites
- http://www.thinkquest.org/library/lib/site_sum_outside.html?tname=50065&url=50065/science/properties.html -- "Color and the World Around You"
- http://www.sciencenetlinks.com/lessons.cfm?BenchmarkID=6&DocID=181 -- Three lessons dealing with the nature of color vision
- http://www.toledo-bend.com/colorblind/Ishihara.html -- a test for color blindness